

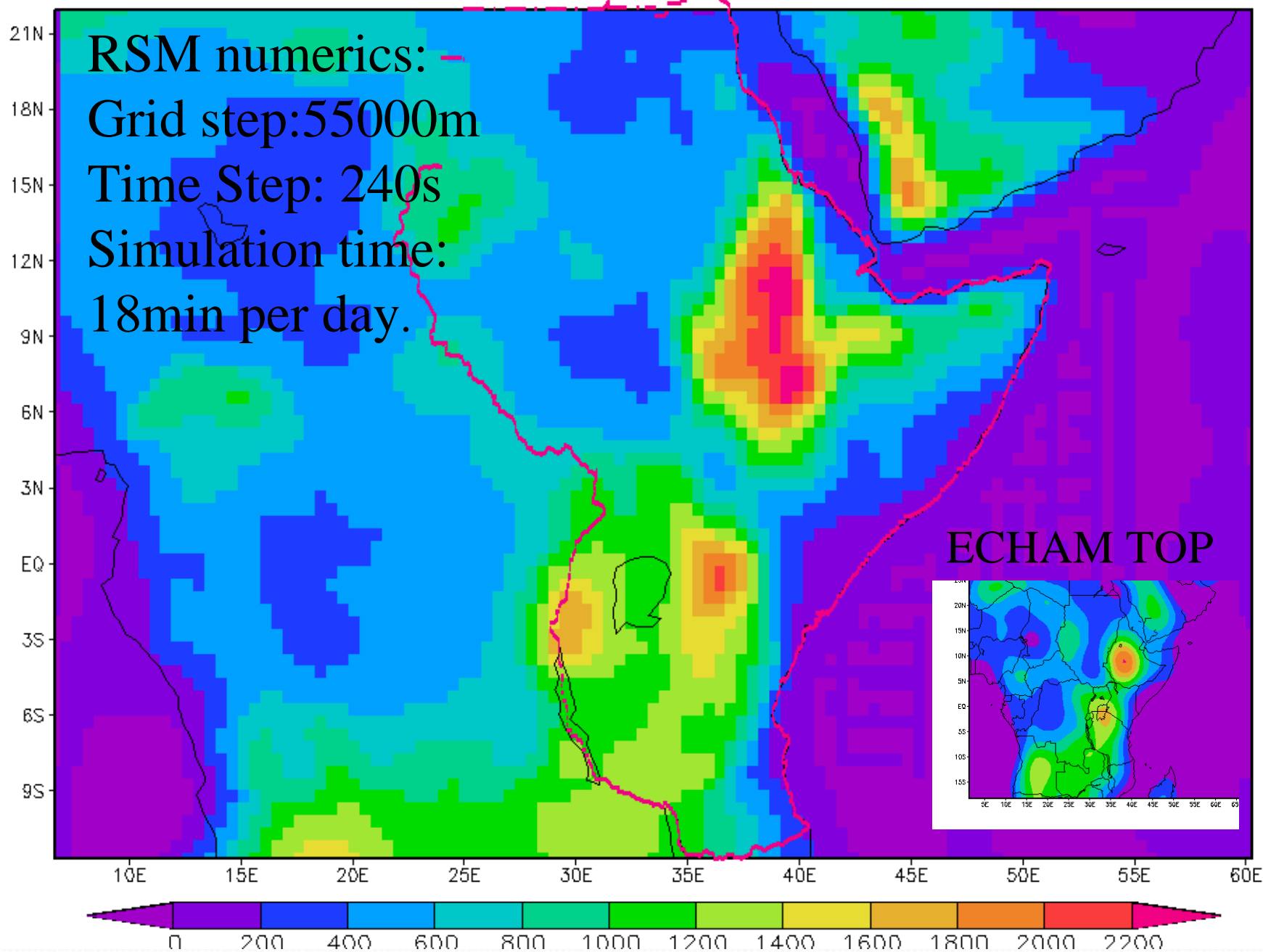
Forecast Skill of RSM in Seasonal Climate Forecasts over Kenya & The GHA: “Potential For Hindcast Verification and RSM Output Statistics with Observations”

By

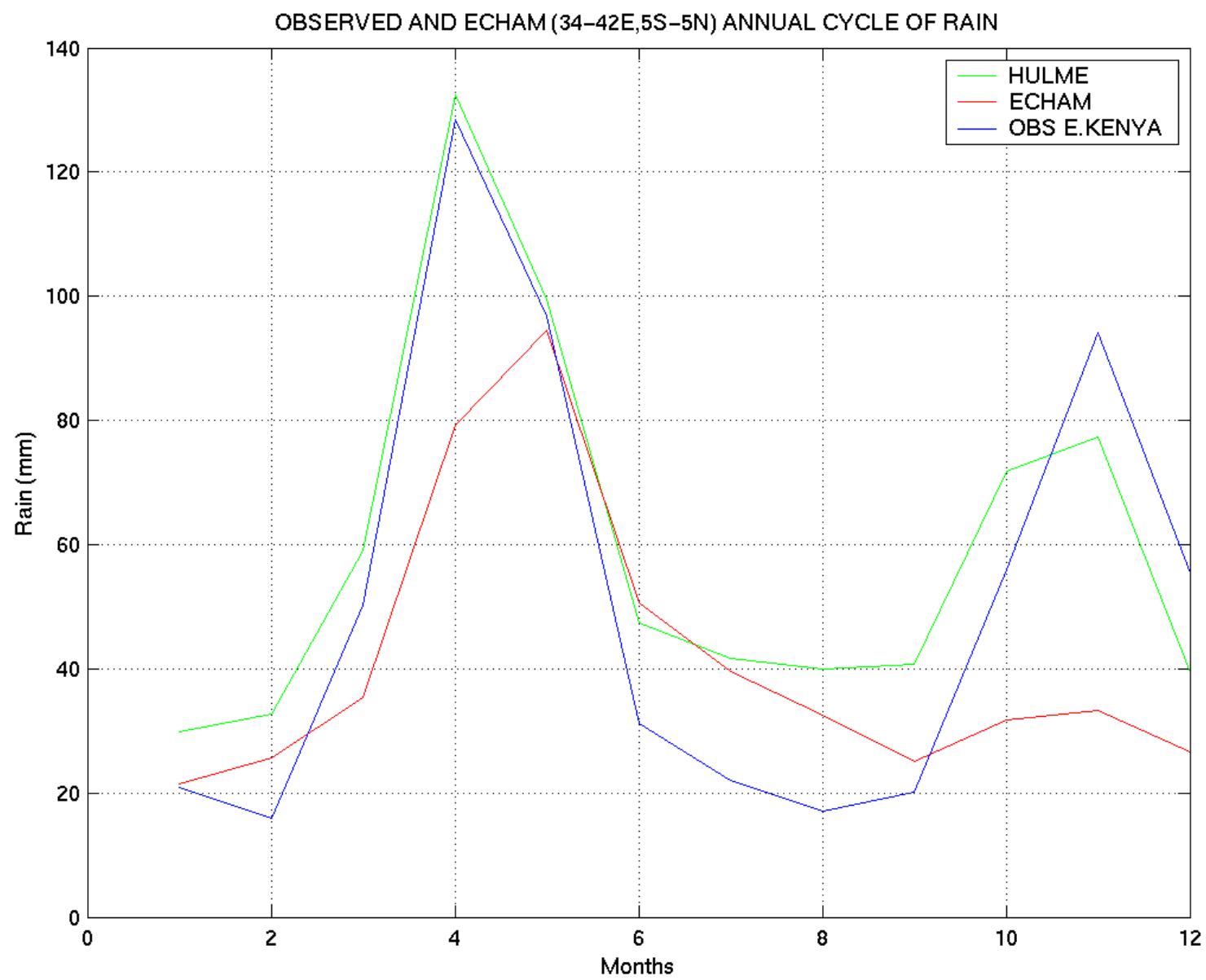
Joseph N MUTEKI
University of Nairobi
Department of Meteorology
P.O. Box 30197 00100 GPG
Nairobi, KENYA

10th International Regional Spectral Model Workshop, 9-13th August 2010
Hokkaido University, School of Environmental Sciences, Sapporo, Japan.

GHA TOPOGRAPHY AT 55km RESOLUTION

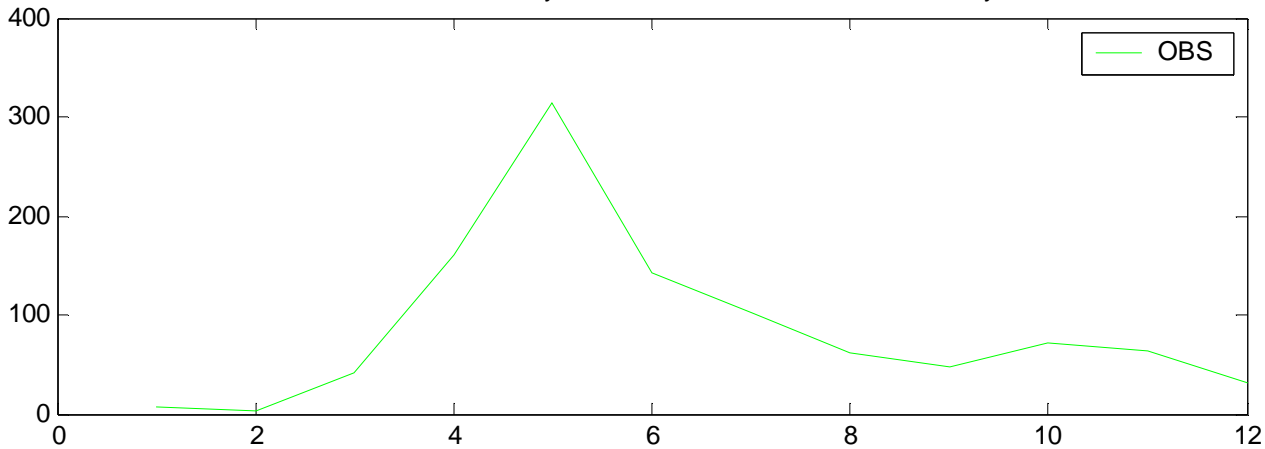


..Rainfall in the Kenya and Equatorial GHA is highly seasonal.....

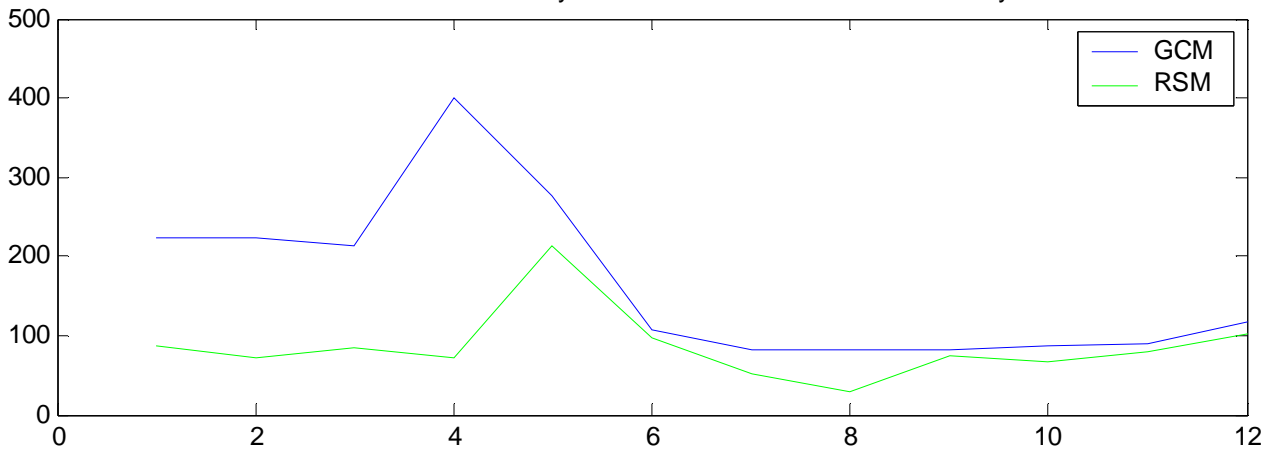


When RSM is used to downscale the GCM forecast... Sample annual cycle Over Eastern & Coastal Kenya ...

Station OBS annual cycle of rainfall: Eastern & Coastal Kenya



GCM and RSM annual cycle of rainfall: Eastern & Coastal Kenya



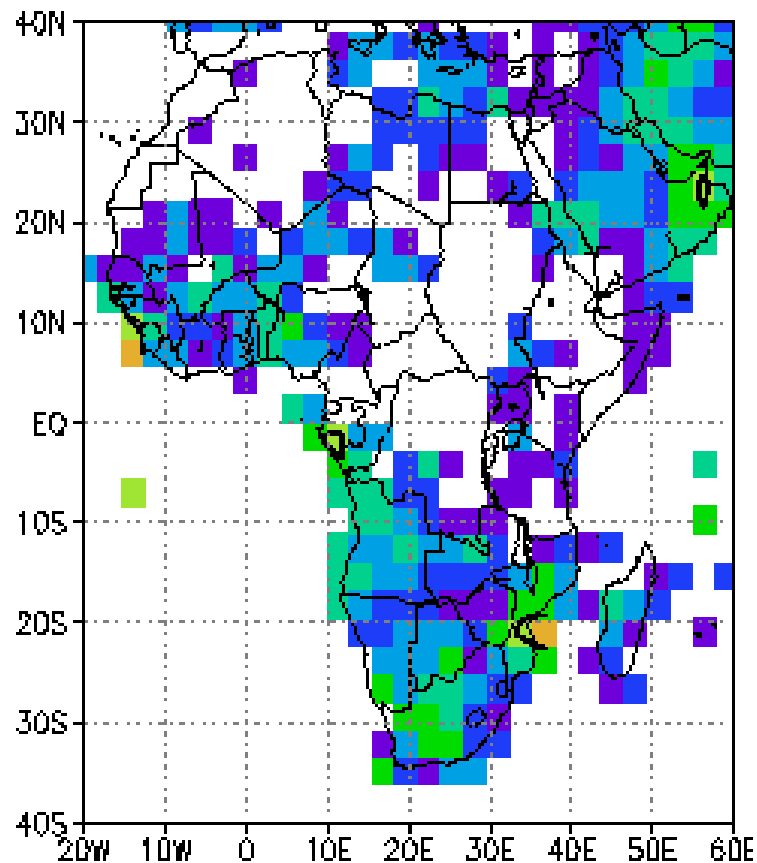
Apparently:

➤ 2nd rainfall season (OCT-DEC) is suppressed in the GCM & RSM.

➤ Nevertheless, it is this 2nd season precipitation that is most predictable with greatest skill by GCMs....

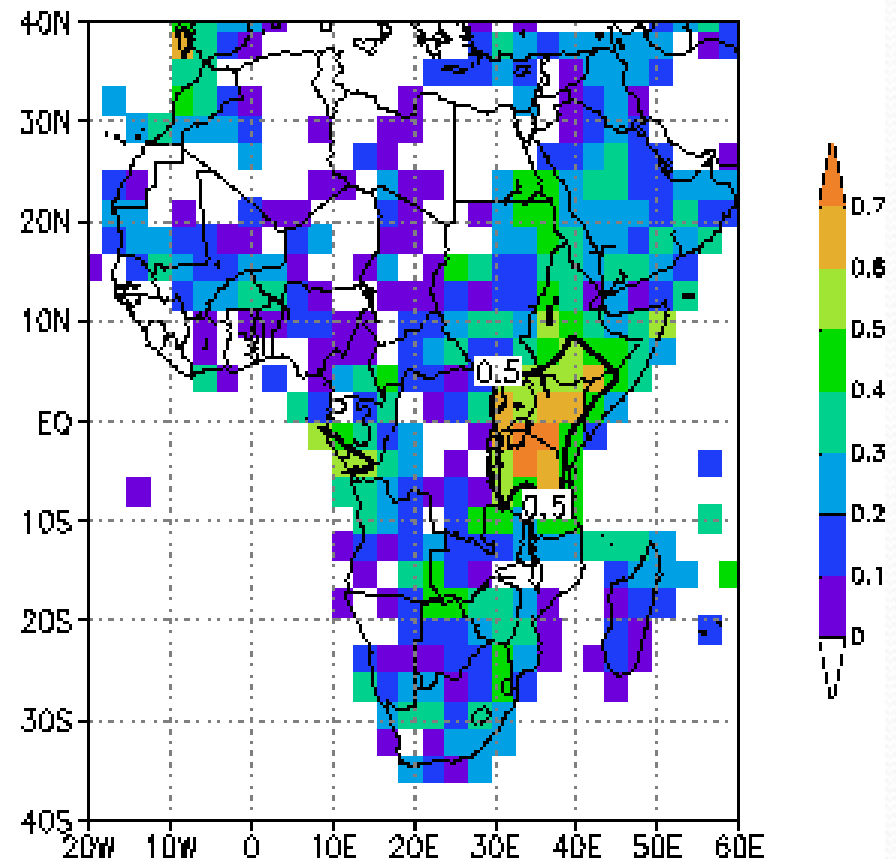
GCM Prediction Skill ...SEASONAL RAINFALL ANOMALY ...CORRELATIONS

MAR. TO MAY. SEASON
ECHAM4.5



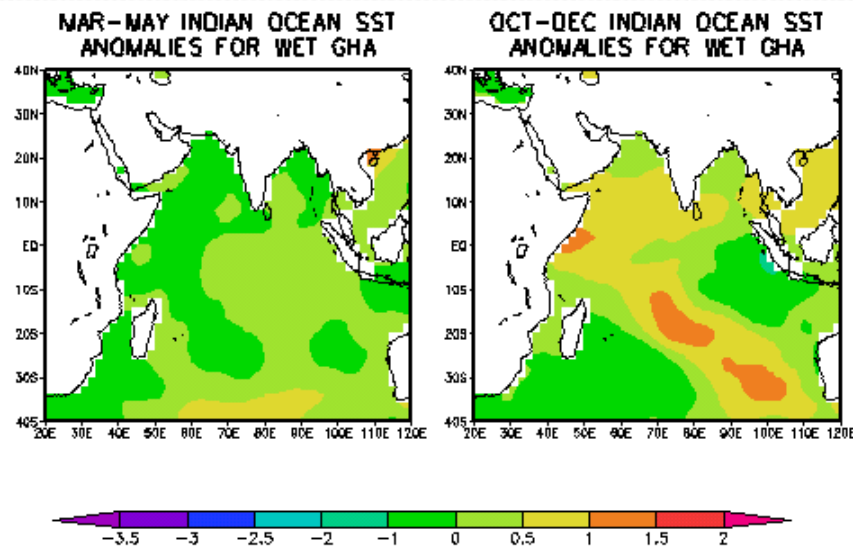
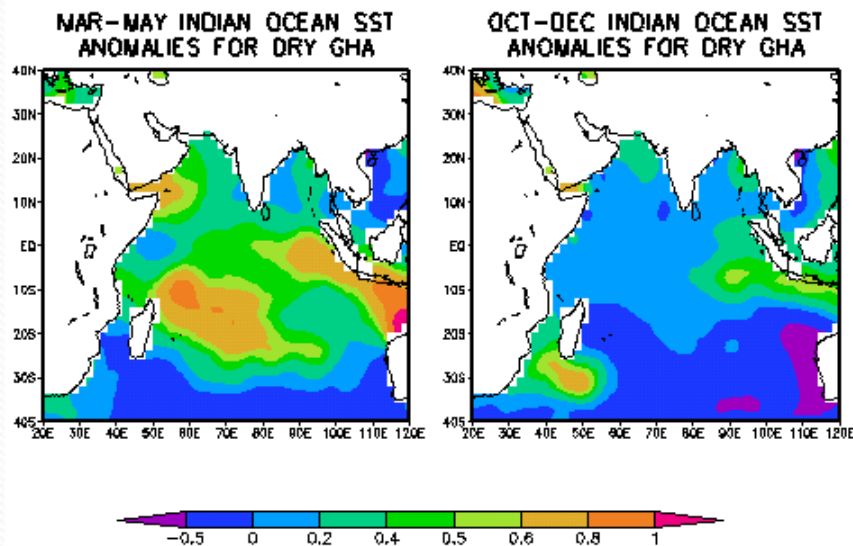
Courtesy of IRI

OCT. TO DEC. SEASON
ECHAM4.5



This signal is basis for the use of RSM in the region...

.....Sources of Predictability for MAM & OND season rainfall in Kenya and Equatorial GHA



...An examples of Sea surface temperature anomaly modes in the Indian Ocean that are associated with seasonal droughts and floods in the GHA during the two wet seasons March-May and October-December.

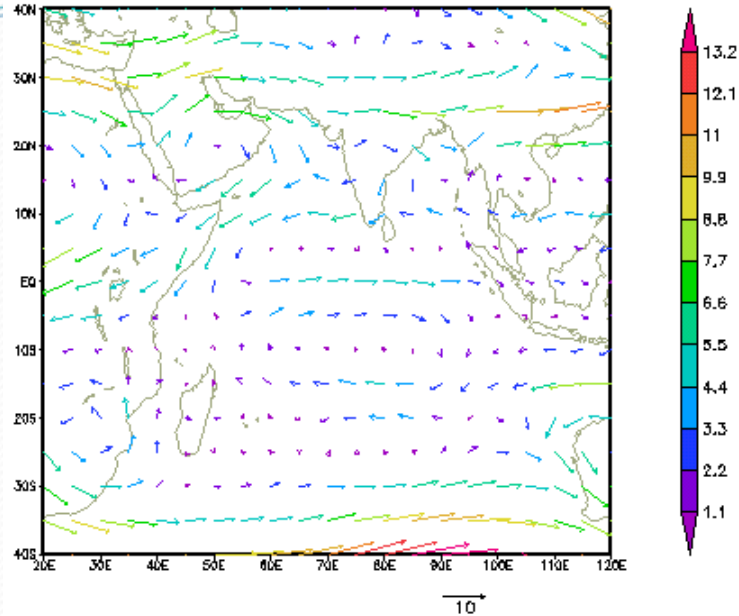
(a) Indian ocean SST anomalies during MAM & OND 2005 (dry Kenya/GHA)

(b) Indian ocean SST anomalies during MAM & OND 1997 (wet Kenya/GHA)

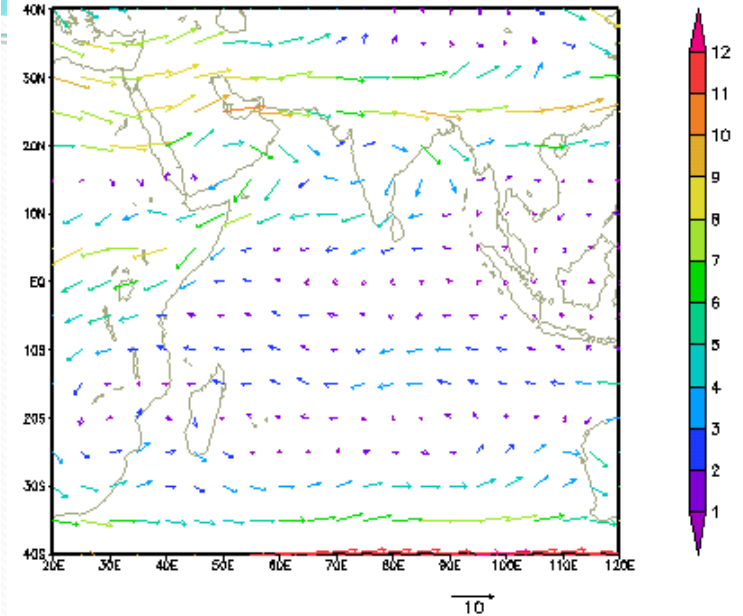
...Atmospheric
Circulation
features over
the IND-GHA
region.

Examples of low &
medium
level circulation
features within the
Indian ocean-GHA
sector for **wet** and
dry years

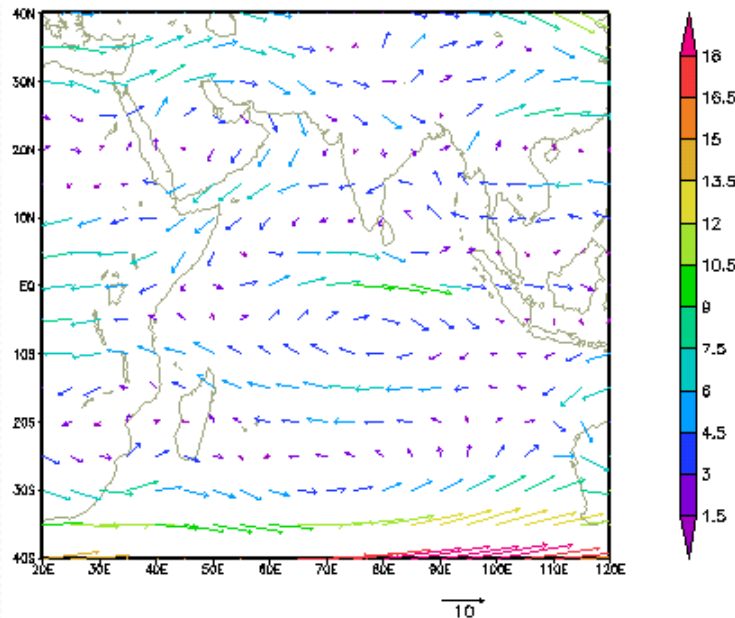
MARCH-MAY SEASON 750mb WIND
CIRCULATION FOR DRY GHA



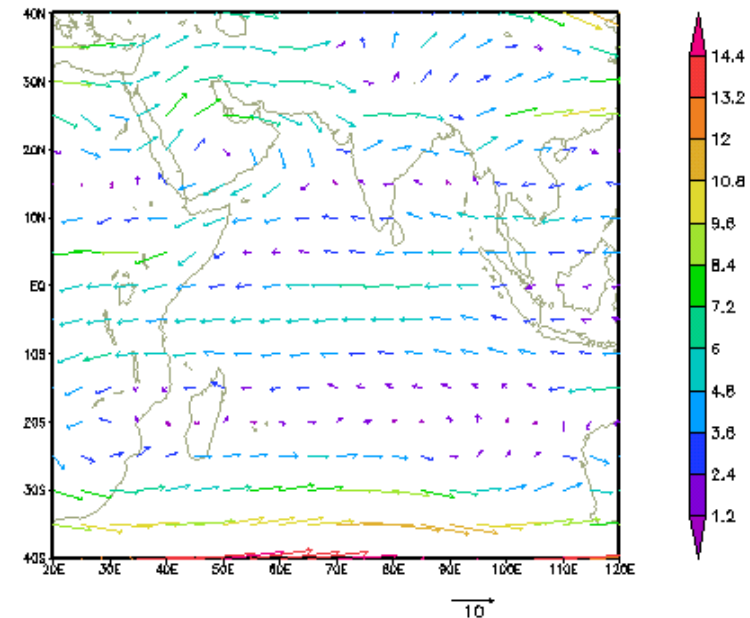
MARCH-MAY SEASON 750mb WIND
CIRCULATION FOR WET GHA



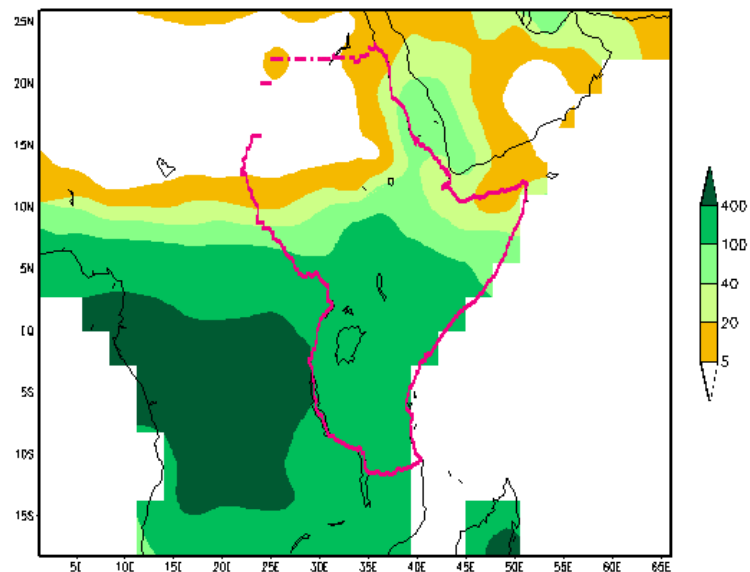
OCT-DEC SEASON 750mb WIND
CIRCULATION FOR DRY GHA



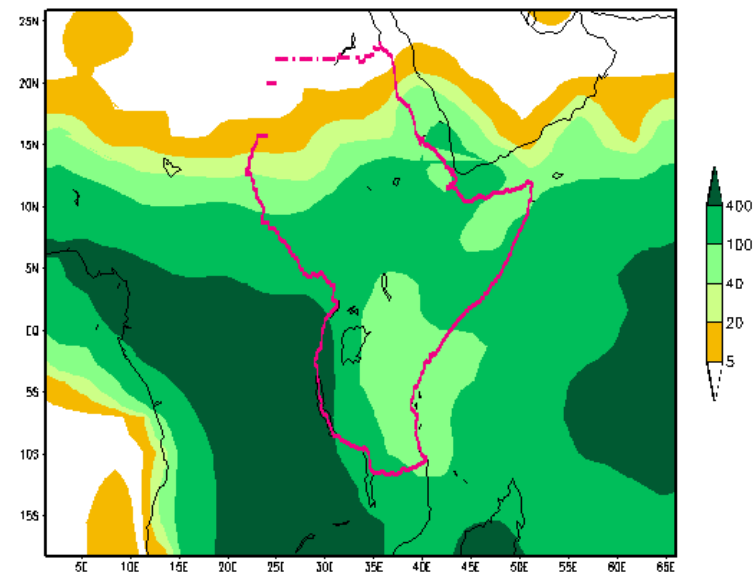
OCT-DEC SEASON 750mb WIND
CIRCULATION FOR WET GHA



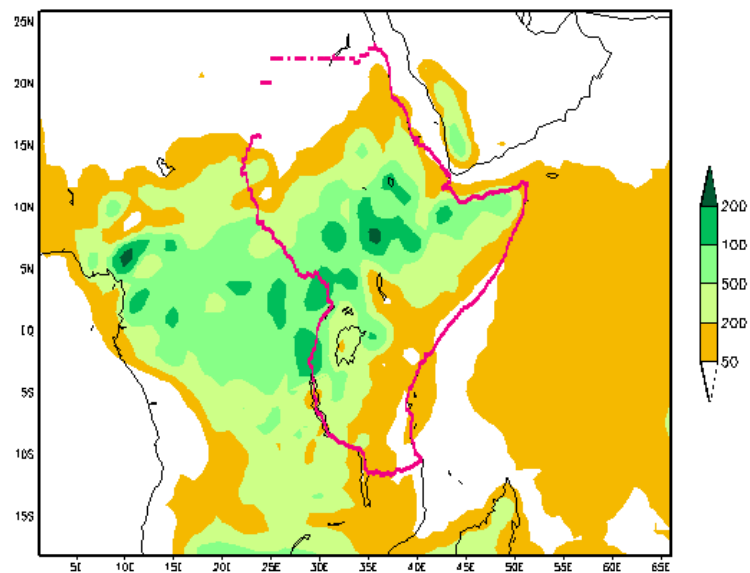
OBS and 1990-1999 CLIMATOLOGY RAIN



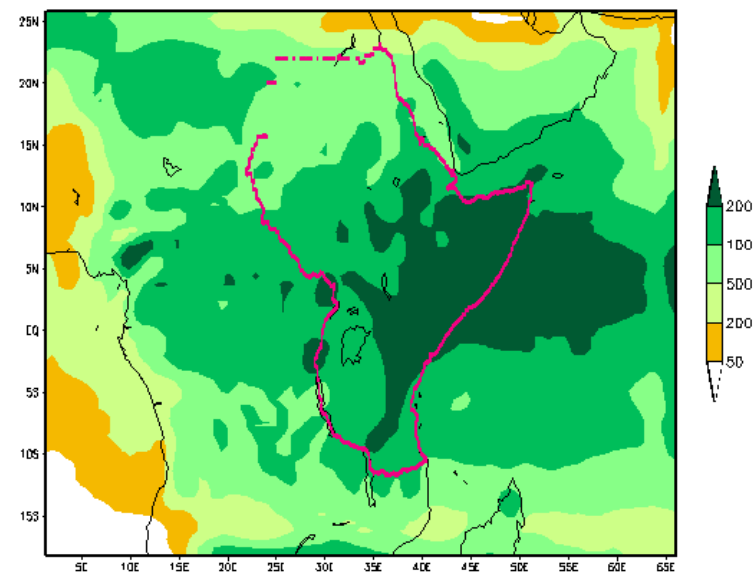
ECHAM17 and 1990-1999 CLIMATOLOGY RAIN



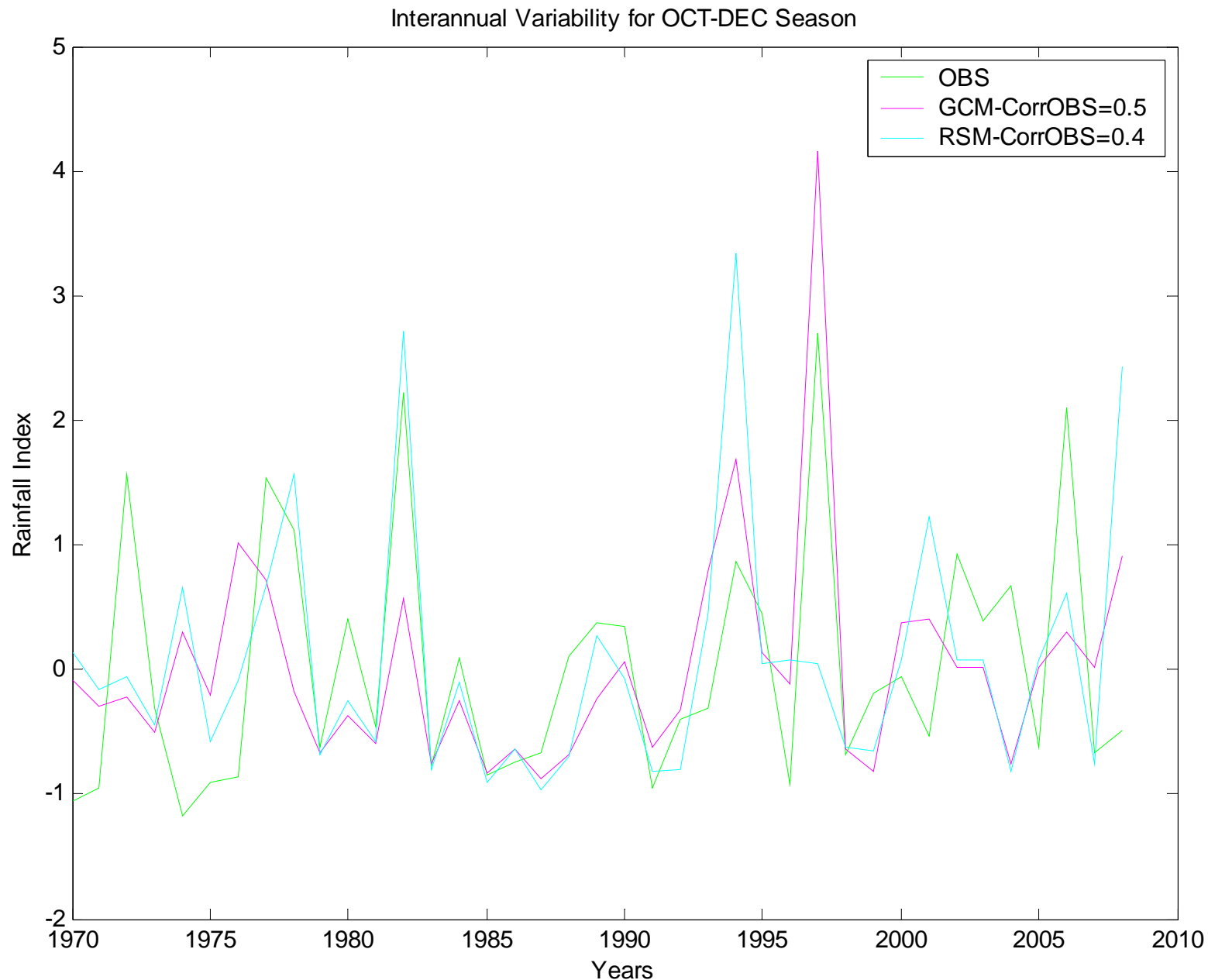
RSMruns1 and 1990-1999 CLIMATOLOGY RAIN

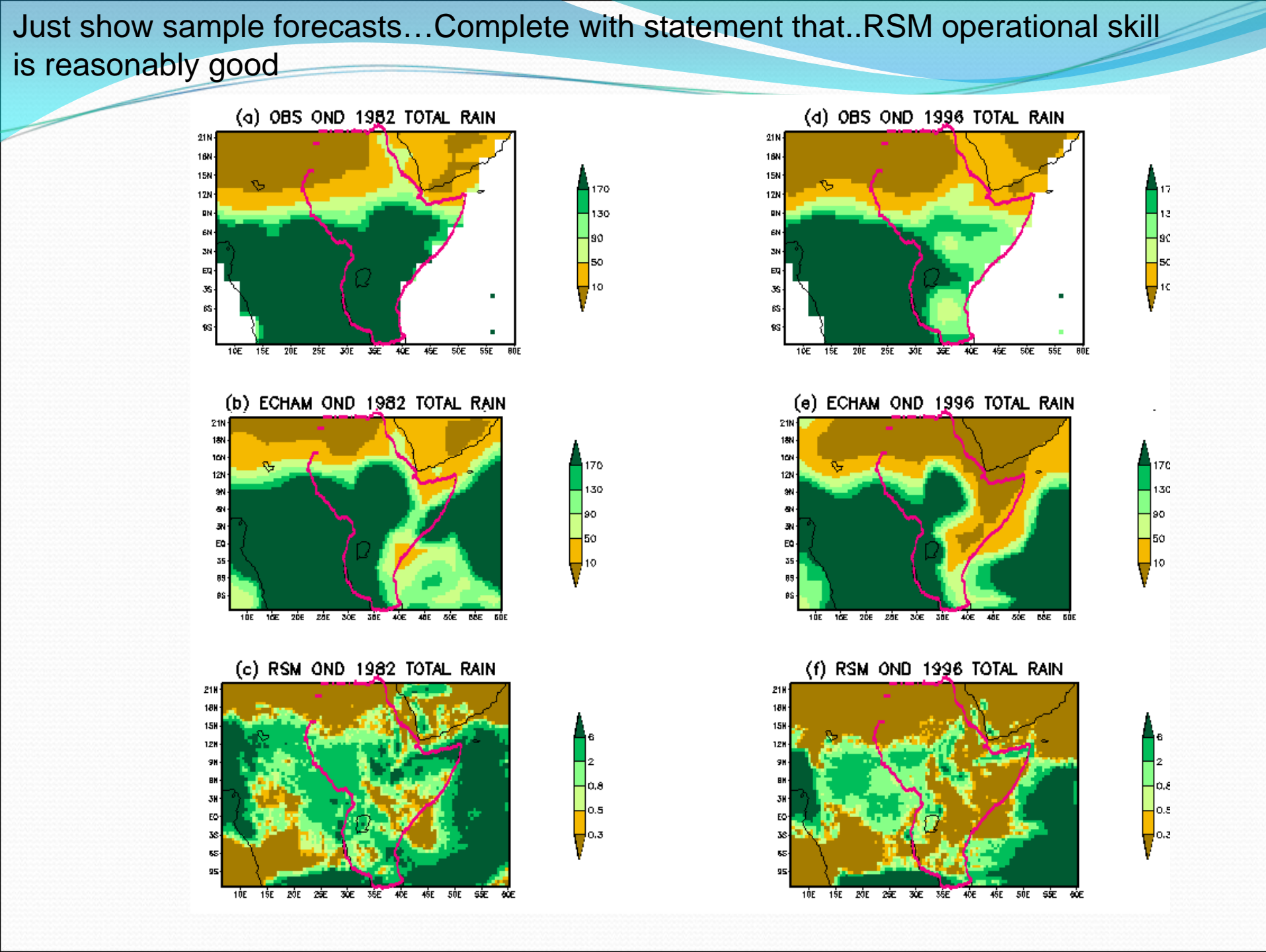


RSMruns2 and 1990-1999 CLIMATOLOGY RAIN

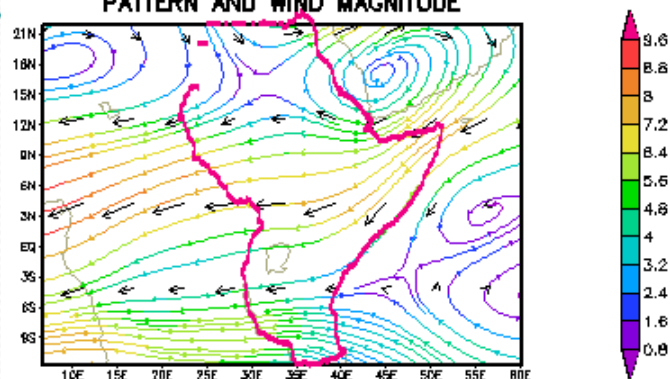


The correlation skill noted here is a good basis for derivation of Hindcast RSM skill for Kenya/GHA region. Furthermore these type of correlations lead to robustness in probabilistic forecasts.

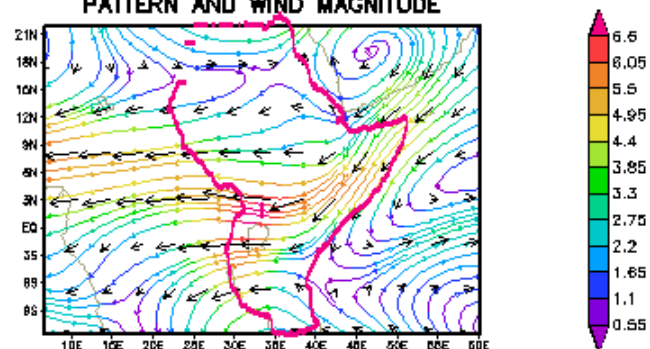




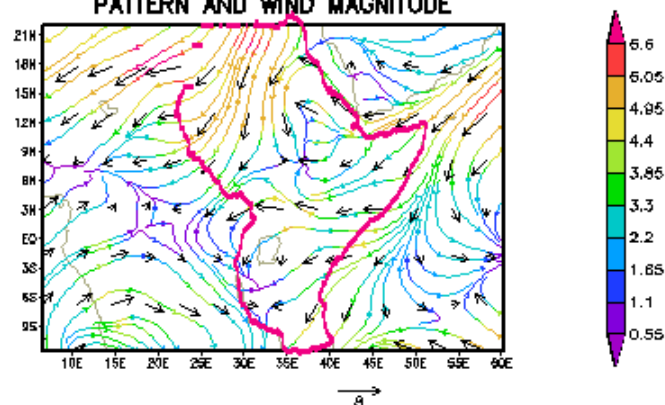
**(a) OBS OND 1982 CIRCULATION
PATTERN AND WIND MAGNITUDE**



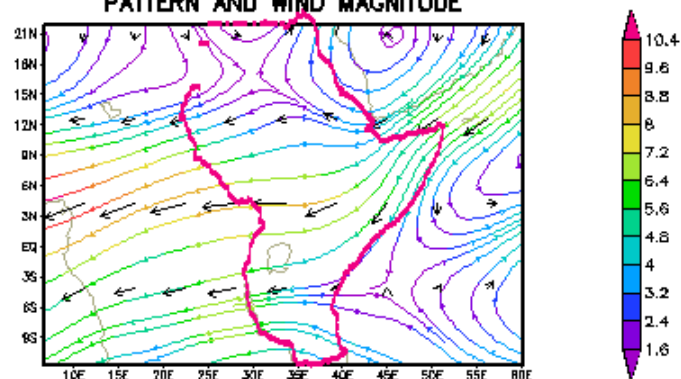
**(b) ECHAM OND 1982 CIRCULATION
PATTERN AND WIND MAGNITUDE**



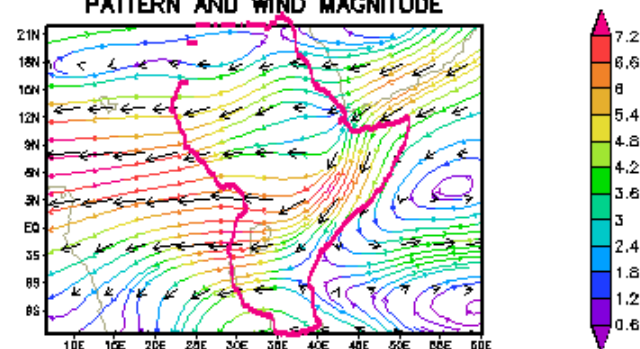
**(c) RSM OND 1982 CIRCULATION
PATTERN AND WIND MAGNITUDE**



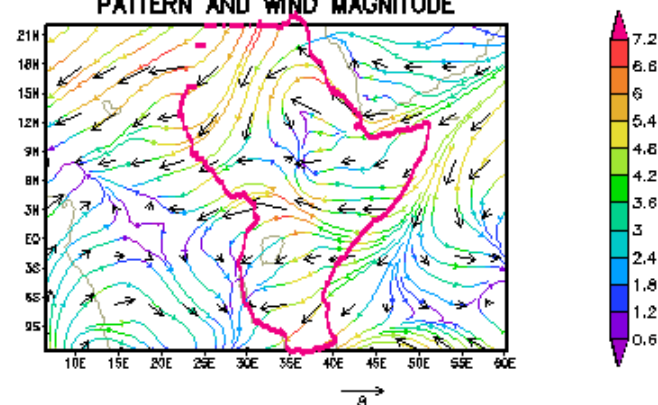
**(d) OBS OND 1996 CIRCULATION
PATTERN AND WIND MAGNITUDE**



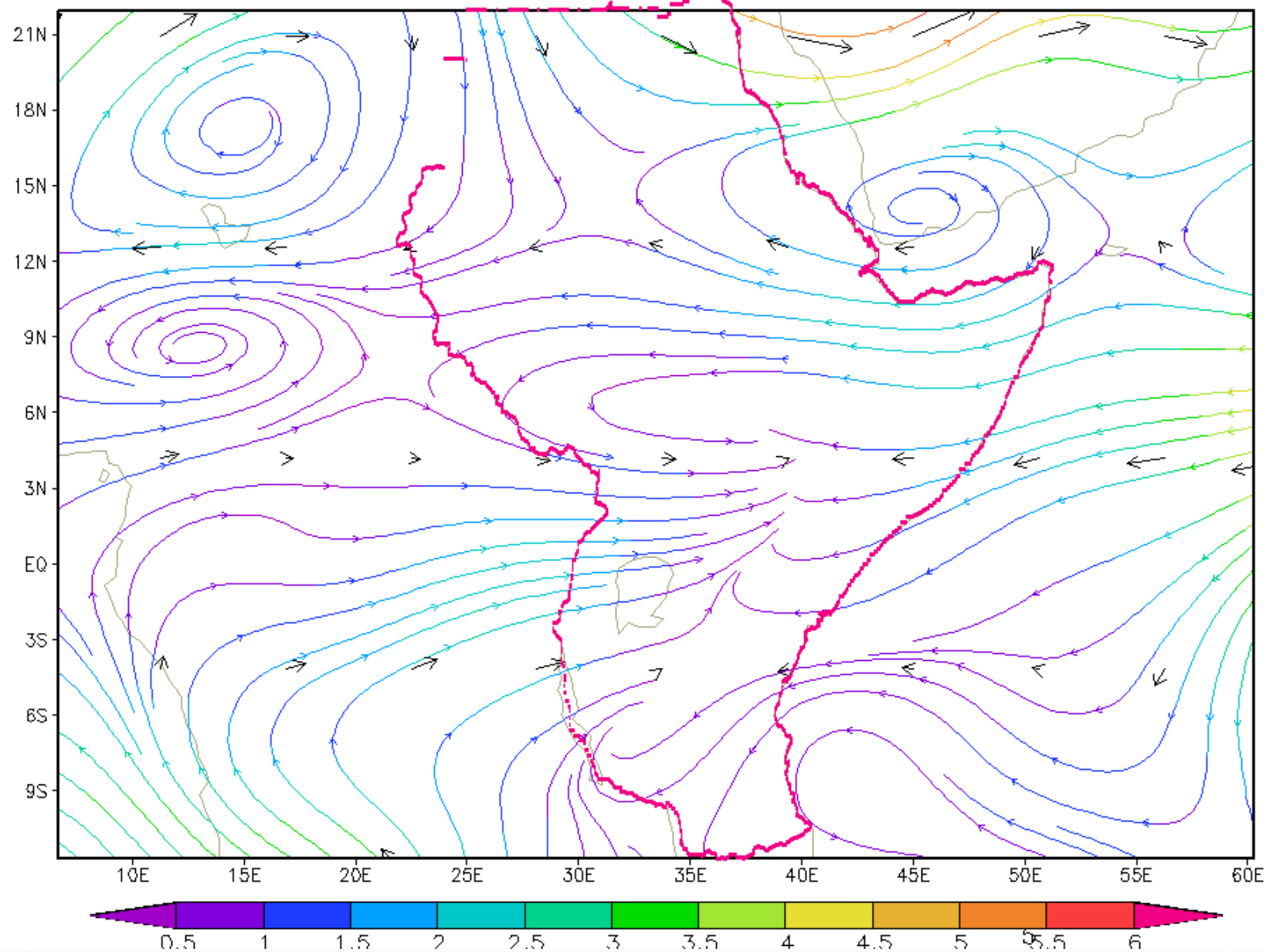
**(e) ECHAM OND 1996 CIRCULATION
PATTERN AND WIND MAGNITUDE**



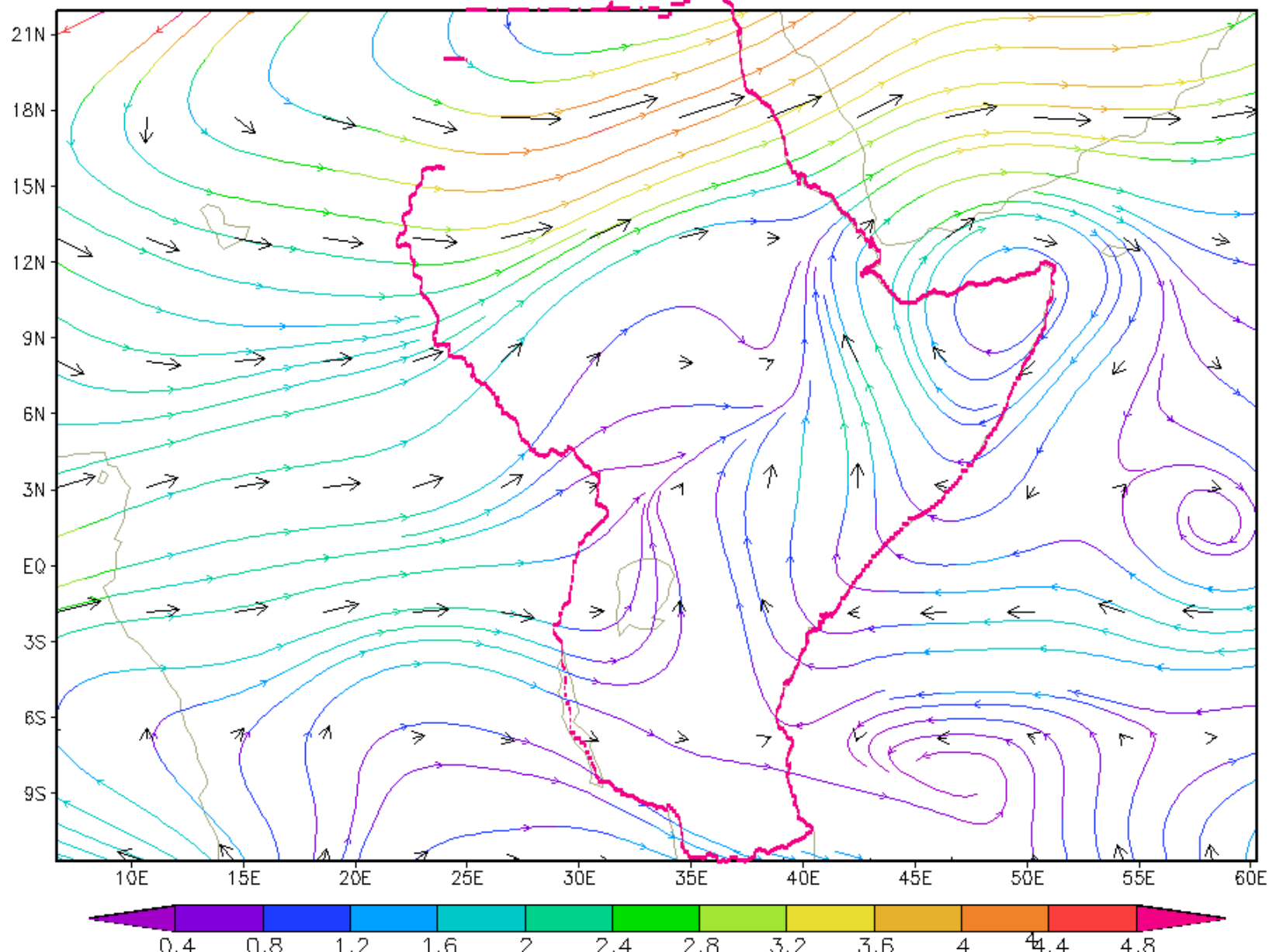
**(f) RSM OND 1996 CIRCULATION
PATTERN AND WIND MAGNITUDE**



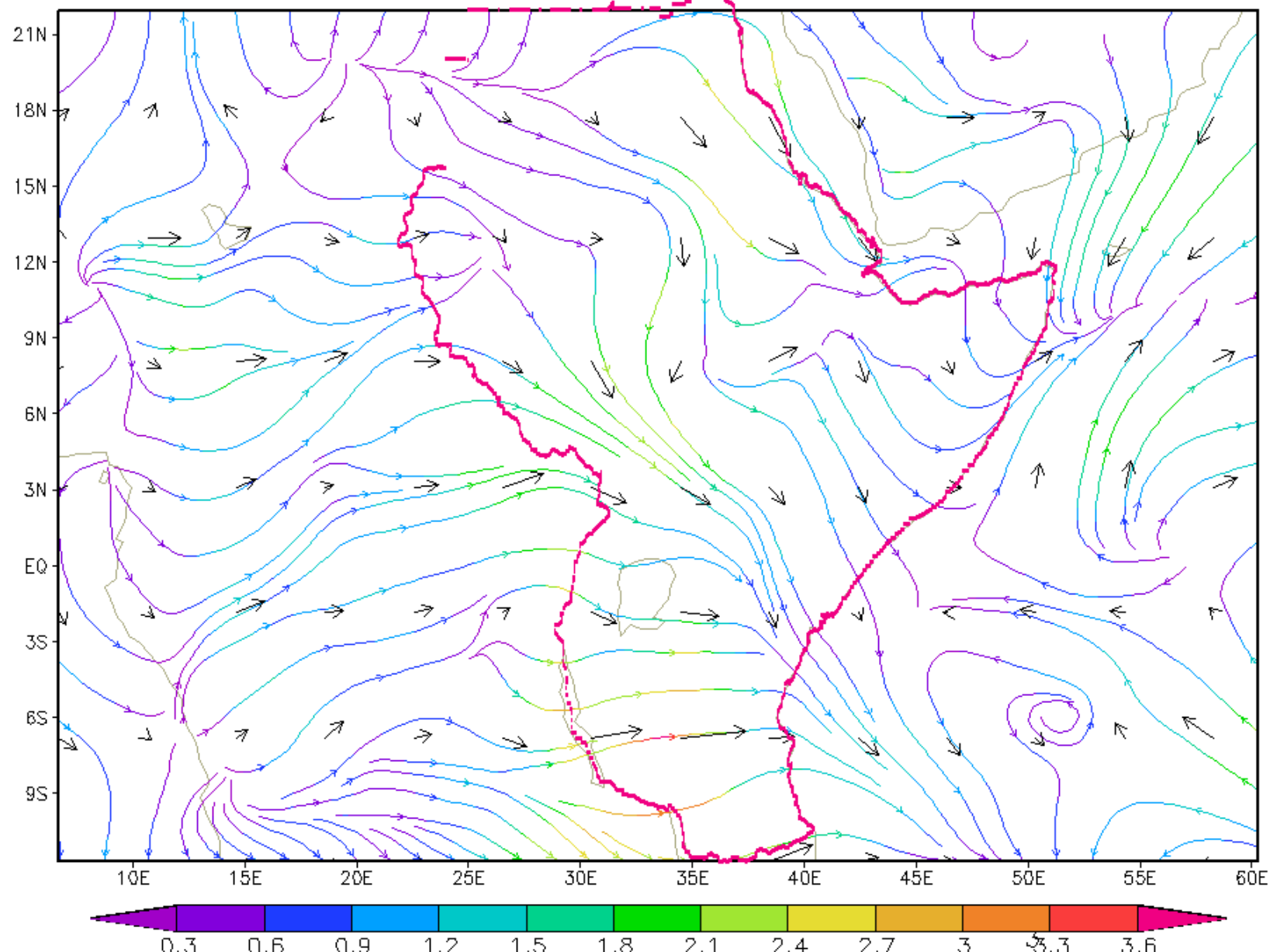
OBS OND WET 1982-DRY 1996 CIRCULATION ANOMALY PATTERN AND WIND MAGNITUDE



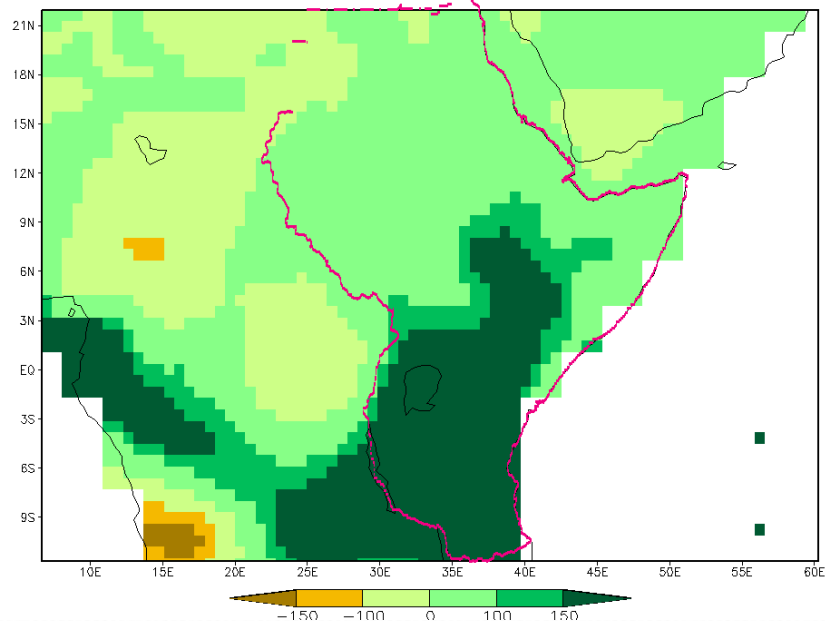
ECHAM OND WET 1982-DRY 1996 CIRCULATION ANOMALY PATTERN AND WIND MAGNITUDE



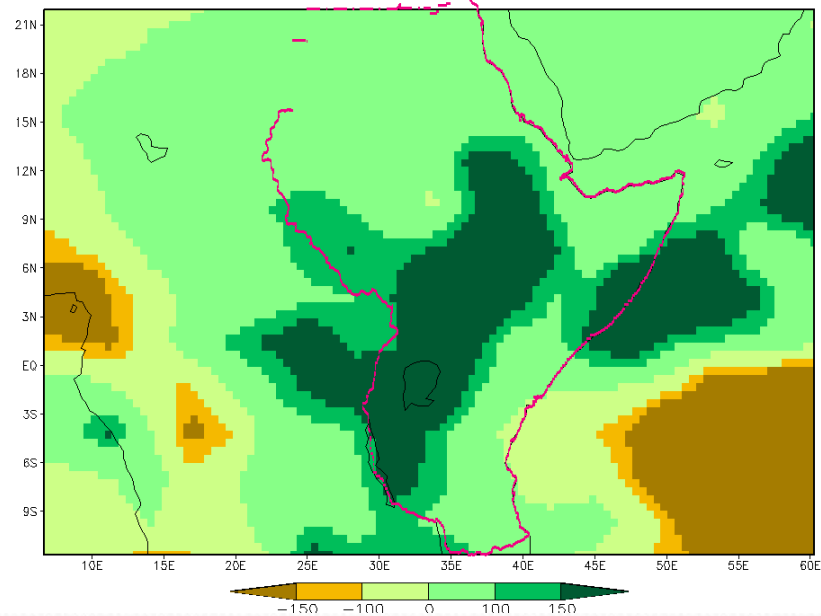
RSM OND WET 1982-DRY 1996 700mb CIRCULATION ANOMALY PATTERN AND WIND MAGNITUDE



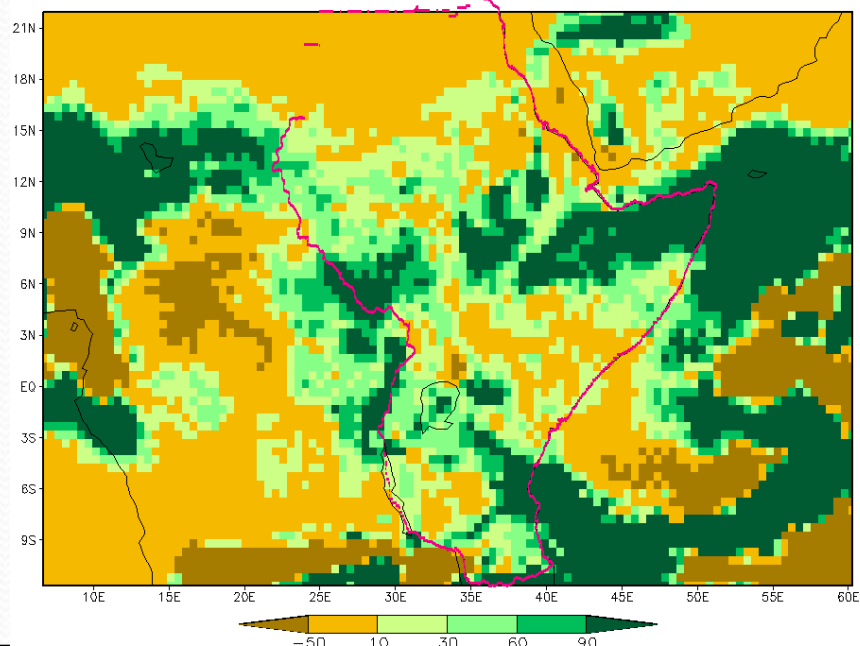
OBS DIFFERENCE OND WET 1982-DRY 1996 ANOMALY RAIN



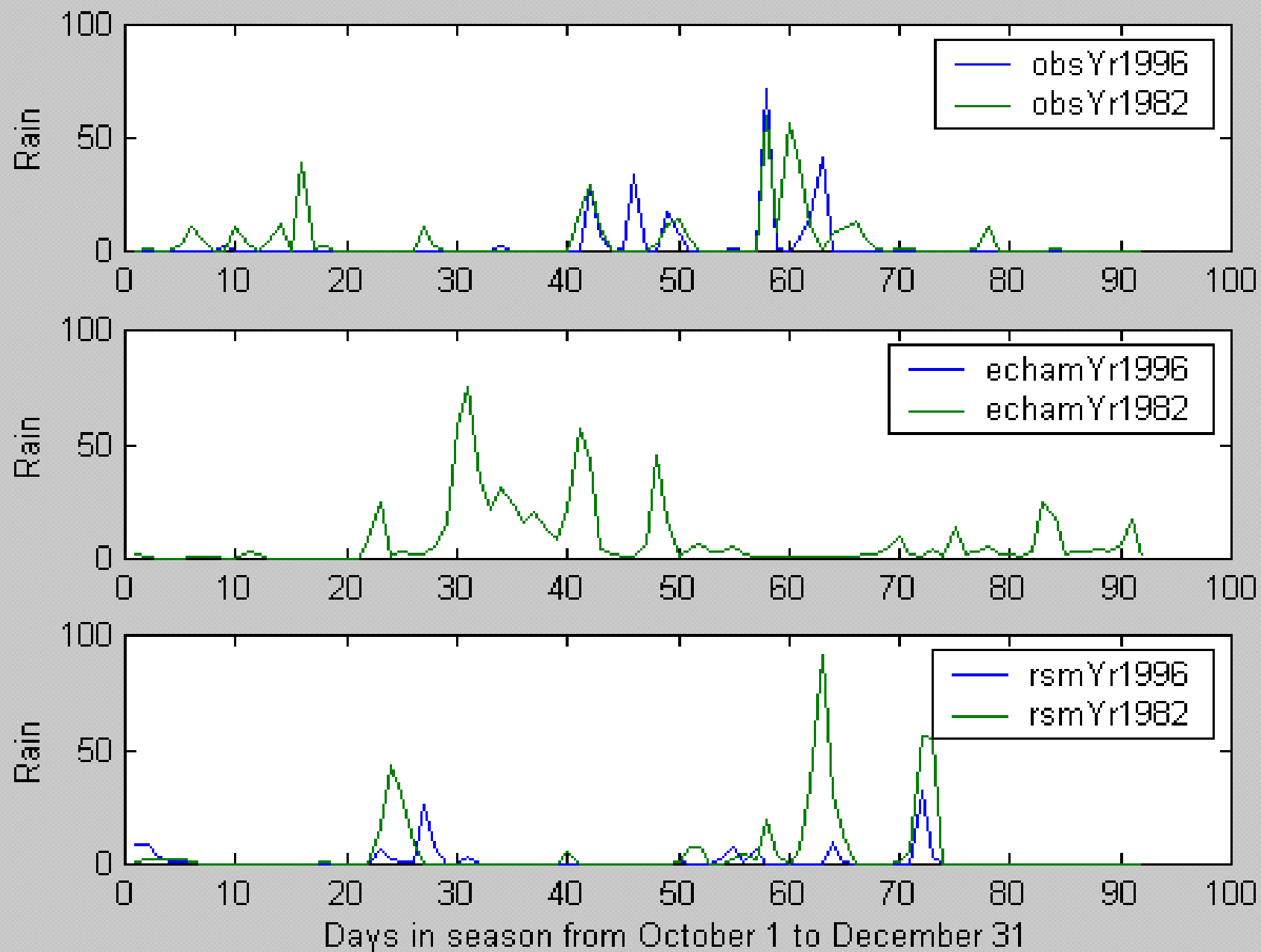
ECHAM DIFFERENCE OND WET 1982-DRY 1996 ANOMALY RAIN



RSM DIFFERENCE OND WET 1982-DRY 1996 ANOMALY RAIN



SAMPLE DAILY PATTERNS



Summary...

- In improving operational climate forecasting for Kenya and Equatorial GHA, the RSM continues to be quite skillful. In resolving the annual cycle of rainfall, there is a apparent suppression of the annual cycle.
- However, the OCT-DEC forecasts using the RSM has valuable spatial temporal details including resolution of intra-seasonal wet-dry spells.
- Although the Raw RSM forecasts can be a major contribution in net seasonal climate forecasts, there is a great potential in improving the RSM performance if converted to the probabilistic forecast products commonly used by providers of climate information in the region. These MOS results will be generated for the region once some hindcast data gaps are re-filled in the climatological data basis of the RSM for the country & region.
- Such products will also give a wide range of skill score measures that will be very useful in assessing the operational attributes of the RSM in the country and region.

ACKNOWLEDGEMENTS

- Thanks to RSM Steering Committee for facilitating this workshop. It is valuable learning & updating experience to us who use RSM without having to bother about the in-depth details of the model attributes.....
 - Thanks to Ministry of Environment, Japanese Government for providing Organizing committee with resources that have enabled me and others to attend and participate in this workshop.
 - The organizing local organizing committee: Prof Inatsu and his team have done RSM community proud!
 - Thanks to my own institution, University of Nairobi, Kenya for granting me official leave to participate in this workshop.
 - To all of you
 -
 -
- ありがとう (Arigatō)